

## Liberal Use of Antibiotics in Dentistry

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### ABSTRACT

Ever since the emergence of dentistry, there has been wide use of antibiotics seen. It is prescribed for both treatment as well as for prophylactic purposes. Antibiotics popularly prescribed in dental clinic are “Penicillin” and “Amoxicillin”. For patients who are allergic to these drugs or can’t tolerate due to some reason “Clindamycin” is prescribed which is stronger and known for treating much broader range of infections. Approximately around 10% of the antibiotic prescriptions are for dental related problems. 50% of the cases are those where the patient actually requires the drug to treat his or condition whereas the other 50% of the patients are victims of unnecessary prescriptions. There is increase in prescriptions of antibiotics unnecessarily by dentists and also for wrong clinical indications. Frequent and misuse of antibiotics can lead to “Antibiotic Resistance” which is “Global Health Crises”. Antibiotic resistance develops with repeated consumption of the drugs without any concern, with time microbes evolve and that protect themselves from the action of antimicrobials. This study is based on three objectives. The first objective is to understand the indications and prescribing pattern of antibiotics in dental clinic for both therapeutic and prophylactic purposes. The second objective is to analyze the risks associated with antibiotic resistance. The third objective focuses on the recommendations to improve and standardize the antibiotic prescribing behavior, as it will help in curbing the incidence of side effects associated with antibiotics and antibiotic resistance. Study is based on global health perspective.

### Keywords

Antibiotic Resistance, Dental Prescribing, Antimicrobial Resistance, Over Prescriptions, Microbial Evolution

### INTRODUCTION

Dentistry is one of the oldest medical profession dating back to Indus Valley Civilization. So, it can be said that it started around 7000B.C. However, its only after 5000 B.C. that descriptions related to dentistry is available. By 1700s dentistry became more defined as a profession. First dental college (Baltimore College of Dental Surgery) was established in the year 1840. First toothpaste was produced by “Coalgate” in the year 1873 followed by production of toothbrushes few years later. Like this dentistry evolved as a profession and as evolution continued more and more developments were seen. (LEE & CHAI, 1962)

Antibiotics are drugs which prevent or cure the infections caused due to bacteria. Their mechanism of action is either related to killing of bacteria or stopping its reproduction. Antibiotics can be administered through oral route as liquid, tablet or capsule or through intramuscular or intravenous route in the form of injection for rapid action. Antibiotics are also available as creams, ointments, lotions and oral applicants to treat skin and oral gingival infections. (Willacy, 2020)

There are several types of antibiotics available and each work against only a particular type of bacteria or parasite so administering of the right drug is important to avoid misuse of wrong drug and overtime resistance. There are some common types of antibiotics as well as some specialized antibiotics prescribed by particular specialist only particular health condition like tuberculosis. (Willacy, 2020)

The main types of antibiotics include:

<b>Type</b>	<b>Examples</b>
Penicillins	phenoxymethylpenicillin, flucloxacillin and amoxicillin
Cephalosporins	cefaclor, cefadroxil and cefalexin
Tetracyclines	tetracycline, doxycycline and lymecycline
Aminoglycosides	gentamicin and tobramycin
Macrolides	erythromycin, azithromycin and clarithromycin
Lincomycin antibiotics	Clindamycin
Sulfonamides and trimethoprim	co-trimoxazole
Quinolones	ciprofloxacin, levofloxacin and norfloxacin
Metronidazole and tinidazole for Parasitic Infections	
Nitrofurantoin - used for urinary infections	

**Table 1: Main types of antibiotics prescribed in day-to-day life**

Antibiotics usage started in the year 1928 with the discovery of penicillin (the first antibiotic) by “Alexander Fleming”. It was the probable cure to avoid deaths against infections. During the same time dentistry was emerging as a specialized branch of science. Antibiotics usage started sparingly in dentistry during that time for treatment of various conditions to avoid systemic diffusion of bacteria. (Guerrini et al., 2019)

After the third industrial revolution, a transition was seen in people’s life and food habits. People started increased consumption of sweets and refined carbohydrates. Around 1964, maximum incidences of dental caries were seen. This led to increased usage of antibiotics in dentistry for endodontic complications and treatments. Antibiotics not only treated the infections but also prevented from systemic diffusion. (Guerrini et al., 2019)

With time antibiotics usage increased in dentistry. Following of recommendation dosages and administration is essential to avoid complications and to protect the patient from drug resistance. Over prescribing and prescribing in cases where it’s not necessary should be avoided. In cases, where there is doubt, believe upon anecdotal evidence or prescribe the wise and conservative course. (Oberoi et al., 2015)

## **OBJECTIVES**

This study is based on 3 objectives.

- I. Understanding the indications and prescribing pattern of antibiotics in dental clinics for both therapeutic and prophylactic purposes.
- II. Analyzing the risks associated with antibiotic resistance
- III. Recommendations to improve and standardize the antibiotic prescribing behavior.

## **LITERATURE REVIEW**

Oral cavity consists of numerous microorganisms. Some authors also claim the presence of more than 500 different species. (Oberoi et al., 2015). They are known as oral microbial flora. It may vary slightly in between person to person based upon factors such as genetics, age, stress, nutrition and diet of the individual.

Bacteria commonly found on the surfaces of oral mucosa are:

<b><u>Bacterium</u></b>	<b><u>Mouth</u></b>	
Staphylococcus Epidermis (1)	++	
Staphylococcus Aureus* (2)	+	
Streptococcus Mitis	++	
Streptococcus Salivarius	++	
Streptococcus Mutans*(3)	++	
Enterococcus Faecalis*(4)	+	
Streptococcus Pneumoniae*(5)	+	++ = Nearly 100%
Streptococcus Pyogenes*(6)	+	+ = Common (about 25%)
Neisseria sp. (7)	+	+/- = Rare (less than 5%)
Neisseria Meningitidis*(8)	+	(*) = Potential Pathogen
Enterobacteriaceae (E. Coli) * (9)	+	
Proteus sp.	+	
Pseudomonas Aeruginosa*(10)	+/-	
HaemophilusInfluenzae*(11)	+	
Lactobacillus sp. (13)	++	
Clostridium sp.*(14)	+/-	
Corynebacterium (16)	+	
Actinomycetes	+	
Spirochetes	++	
Mycoplasmas	+	

**Table 2: Bacteria commonly found in oral mucosa**

To prevent infections due to these microbes, antibiotics is always prescribed for prophylactic measure before the treatment. The paradigm of this type of treatment is also to prevent the risk of bacterial endocarditis. Patients can be at risk of endocarditis also while performing any invasive procedure in oral cavity. Prophylactic care has also been recommended by “American Heart Association”.(Ghosh, 2019)

AHA has given the proper guidelines to be followed for antibiotic drug usage.

<b><u>Antibiotic</u></b>	<b><u>Indication</u></b>	<b><u>Dose</u></b>	<b><u>Timings</u></b>
Amoxicillin	Standard	2 g po, *50 mg/kg po	1 hour before
Ampicillin	If oral route cannot be administered	2 g im or iv, *50 mg im or iv	½ hour before
Clindamycin	Allergy to Penicillin	600 mg po, *20 mg/kg	1 hour before
	Allergy to Penicillin and oral route cannot be administered	600 mg po or iv, *20 mg/kg iv	½ hour before
Cephalexin or Cefadroxil	Allergy to Penicillin	2 g po, *50 mg/kg po	1 hour before
Azithromycin or Clarithromycin	Allergy to Penicillin	500 mg po, *15 mg/kg po	1 hour before
Cefazolin	Allergy to penicillin and oral route cannot be used	1g im or iv, *25 mg/kg	½ hour before

\*pediatric dose; \*po:oral route; \*\*iv:intravenous route; \*\*\* im:intramuscular route.

**Table 3: Antibiotic prophylaxis against bacterial endocarditis in oral procedures (AHA)**

*Credits: “American Heart Association”*

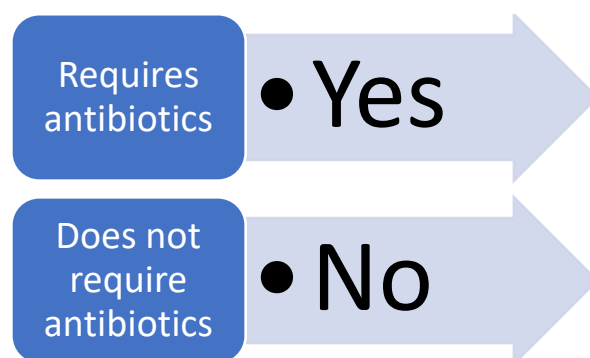
Therefore, it can be said that antibiotics are essential part of dentistry. But overtime there has been increase in drug overdose, misuse, unnecessary prescriptions and wrong prescriptions due to wrong clinical indications. This risk the patients to antibiotic resistance. Such incidences lead to the evolution of the microbes making the drugs ineffective even when administered later for other purposes. (*Antibiotics That Dentists Prescribe Are Unnecessary 81% of the Time -- ScienceDaily*, n.d.)

Oregon State University researchers identified near 170,000 dentists written antibiotic prescriptions in between the year 2011 to 2015 through a national healthcare claims database. It shows undoubtedly the large numbers. 57% of the patients were female with median age of 63. More than 90 % of the patients from database (170,000) underwent a procedure to check if they took the antibiotics, ahead of time. Almost 21% of these people had some form cardiac condition which makes them mandatory to consume antibiotics as per guidelines by “American Heart Association”. Preventive medication in remaining patients gave more risks than benefits. Others facts identified from the same study is that majority of unnecessary prescriptions where from urban areas than rural areas. “Clindamycin” was identified as the most popularly prescribed drug. (*Antibiotics That Dentists Prescribe Are Unnecessary 81% of the Time -- ScienceDaily*, n.d.)

For patient safety thereby its important to change the working of the practitioners. Today patient safety is challenge which can be achieved by strict protocol and practice sops.



**Figure 1: Complete Evaluation Criteria**



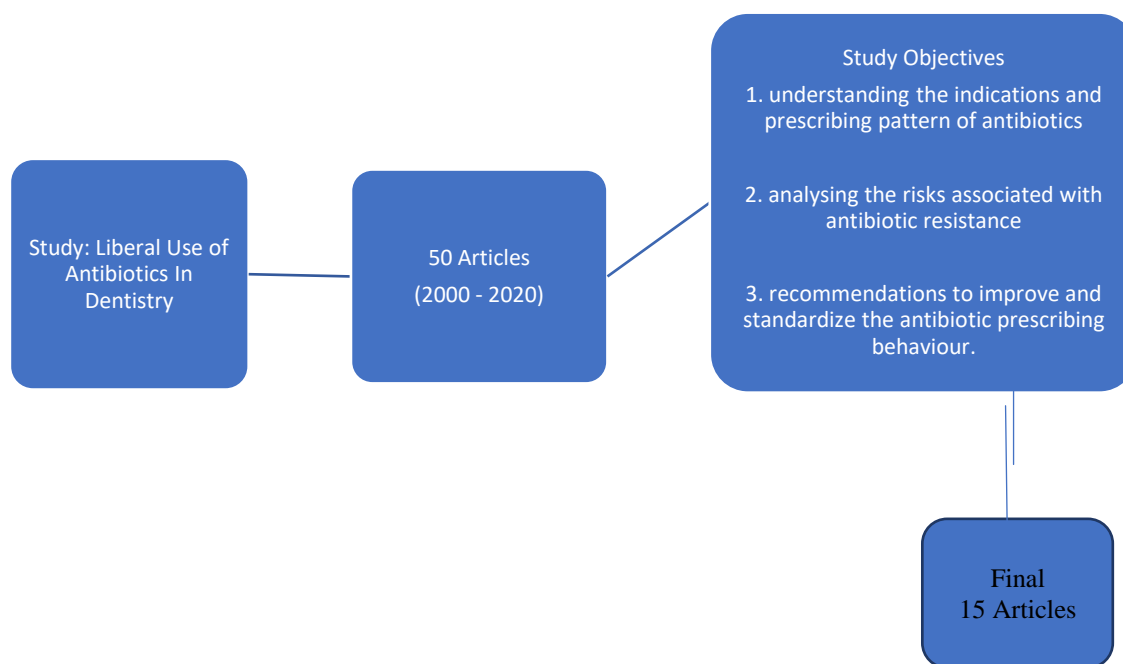
**Figure 2: Based Upon Complete Evaluation Criteria**

## METHODOLOGY

This study is based on secondary sources of data obtained from previously published journals, books and assortment of knowledge from internet. Data is also collected from reliable public domains related to health like WHO (World Health Organization), IMC (Indian Medical Council), IDC (Indian Dental Council), Ministry of Health, etc....

A database of around 50 articles were initially shortlisted which were published during the last 20 years (2000 – 2020). Then study objectives were framed to simplify the study. Based upon the objectives, 15 articles of the total 50 actually matched the study criteria (Objectives).

Thorough reviewing of the final selected papers along with knowledge from portals is collected to frame the study.



**Figure 3: Data Collection Procedure for the Study**

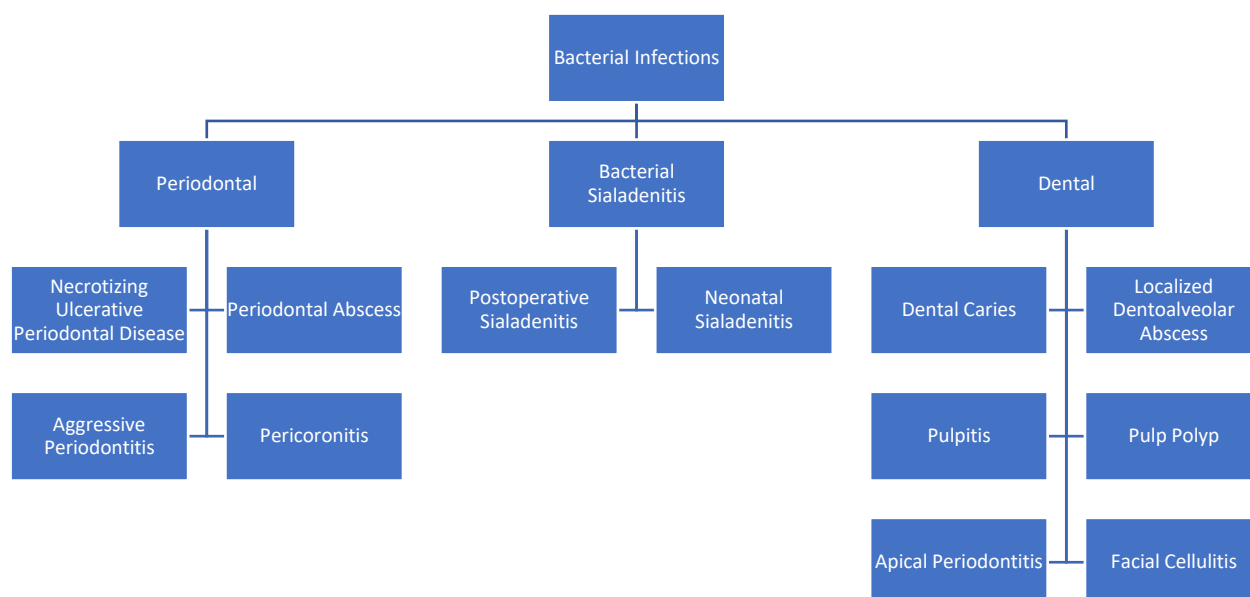
## RESULTS & DISCUSSION

This study was aimed at 3 objectives. The first objective of the study is to understand the indications and prescribing pattern of antibiotics in dental clinics for both therapeutic and prophylactic purposes.

### Indications of Antibiotics

Antibiotics are frequently administered as adjunct to dental treatment when signs of clinical involvement are evident. They are also used in treating immunocompromised patients (Ex: HIV patients) as they systemic involvement is very rapid in such patients. Even after procedures, antibiotics are prescribed to avoid the systemic diffusion of the bacteria especially in the patients with existing cardiac condition or prone to cardiac problem as per guidelines by American Heart Association.(Ramu&Padmanabhan, 2012)

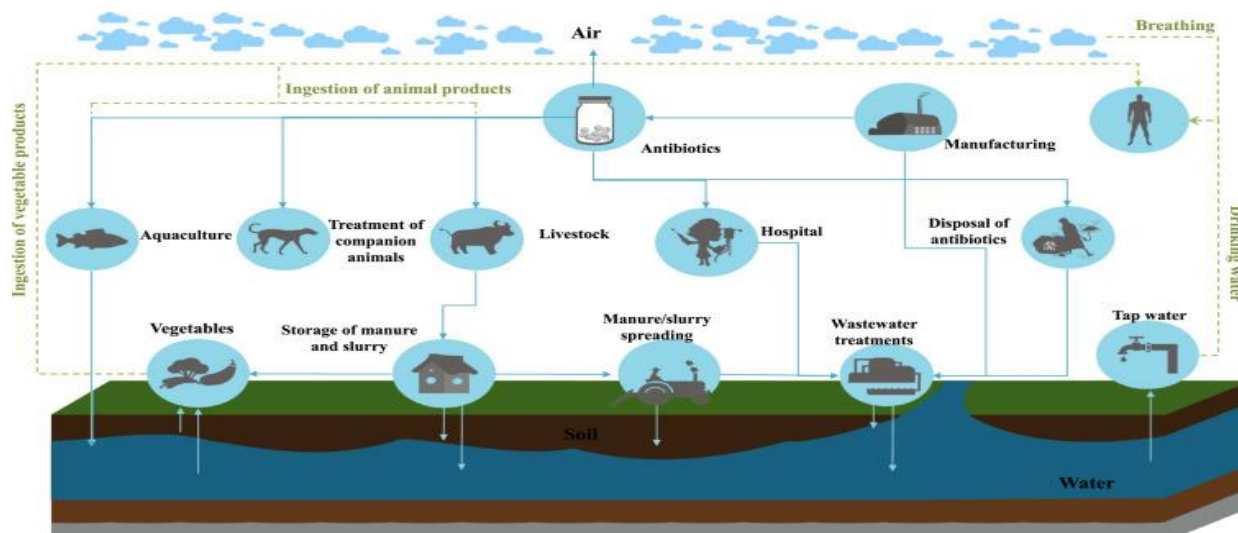
Some of the common indications of antibiotics in dental clinics are:



**Figure 4: Common Indications of Antibiotics in Dental Clinic**

The second objective of the study is to analyze the risks associated with antibiotic resistance. Antibiotic resistance indicates high health risks to human's life. The main concerns can be identified as:(Ben et al., 2019)

- i. Potential risk of antibiotic residue in the environment altering the human microbiome. This will promote the bacterial resistance within the body.
- ii. Potential hazard of creating a selection pressure on environmental microbiome and eventually leading to reservoirs of antibiotic resistance in the environment.

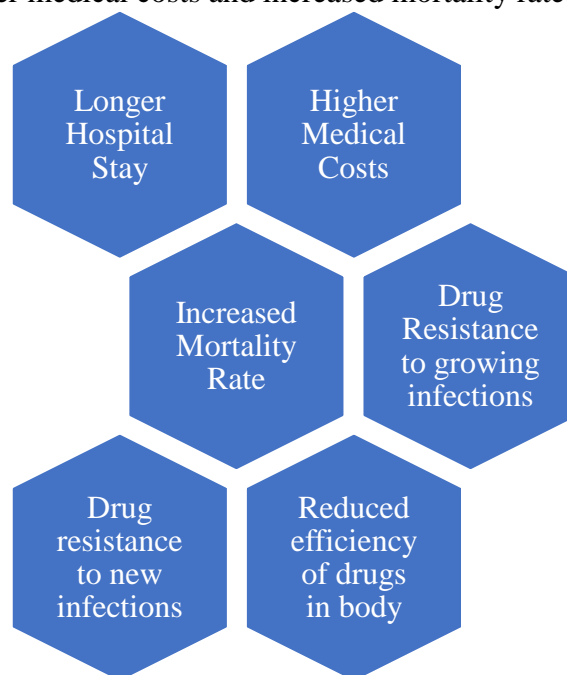


**Figure 5: Human exposure to antibiotic resistance associated with antibiotic residues in the environment.**

*Credits : (Ben et al., 2019)*

There are also several health risks associated with antibiotic resistance. As per “WHO” (World Health Organization), it is one of the biggest threats to “Global Health”, “Food Security” and “Development” today. Since it is associated particularly with the misuse of the drug, it can affect anyone anywhere, irrespective of sex or age. (Pallasch, 2003)

Antibiotics instead of preventing infections, bacterial change in response to medications occur with misuse, unnecessary or overuse of drug. Many of the growing infections like tuberculosis, pneumonia, salmonellosis and gonorrhea are becoming hard to treat as the antibiotics used in treatment are becoming less and less effective. Antibiotic resistance is potent threat to life with longer hospital stay, higher medical costs and increased mortality rate. (Pallasch, 2003)



**Figure 6: Risks associated with antibiotic resistance**

The third objective of this study is to identify the recommendations to improve and standardize the antibiotic prescribing behavior. Its important to identify and take steps at every level to reduce the impact and limit the spread of the infection. (Pallasch, 2003)

#### **Standardization at Individual Level** (Pallasch, 2003)

- i. Antibiotics should be used only when prescribed by a doctor
- ii. Non prescription use of antibiotics and self-medication should be stopped
- iii. Antibiotics should administer as advised by the healthcare professional in proper form time and dosage. Irregular intake should be avoided.
- iv. Expired and leftover antibiotics should never be used. Antibiotics should never be shared as well. Although the diagnosis might be same for two individuals but treatment protocol might vary considering various things like medical history and other associated health problems at individual level.

#### **Standardization at the Level of Policy Makers**(Pallasch, 2003)

- i. “Robust National Action Plan” against eliminating antibiotic resistance should be drafted.
- ii. Surveillance of antibiotic resistant infections must be increased.
- iii. Regulations should be drafted and implemented for appropriate use and disposal of quality medicines.
- iv. Public awareness on the threat of antibiotic resistance

#### **Standardization at the Level of Health Professionals** (Pallasch, 2003)

- i. Prescribe and dispense antibiotics only when required
- ii. Report antibiotic resistant infections to surveillance teams
- iii. Proper guidance to the patients on antibiotics usage and effects of misuse.
- iv. Educate the patients on ways to prevent infections in the first place.

### **LIMITATIONS**

The strength of this study is that it advocates for global health, which is the need of the hour. The limitations to this study are:

- i. It is completed based on secondary literature review and no clinical study or research is conducted at primary level.

### **CONCLUSION**

Antibiotic resistance is threat to the world. When infections become resistant to their first line of standard treatment protocols due to microbial evolution, more and more expensive and advanced medication will be required to treat to same diseases/conditions. Increased cost of medication, hospital charges due to longer inpatient stay will increase the economic and financial burden on the society. To overcome this, standardization should be followed in antibiotics prescription and utilization. Liberal use of antibiotics used should be avoided and should be recommended to patients with clinical evidences only. Dentistry should actively participate in standardization and regulate the prescribing manner as 10% of the total antibiotic prescriptions count for dental ones.



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